

INSPECTION OF EXISTING SYSTEM

CITY OF SEATTLE'S EAST []

MARGINAL WAY TRUNK

PROJECT W210A-21

METROPOLITAN ENGINEERS

152 DENNY WAY MAIN 4-4640

SEATTLE 9, WASHINGTON

January 10, 1961

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W210A-21

INSPECTION OF EXISTING SYSTEM CITY OF SEATTLE'S EAST MARGINAL WAY TRUNK PROJECT W210A-21

To facilitate the design of, and to check the location and condition of that portion of the Elliott Bay interceptor consisting of the city of Seattle's East Marginal Way trunking system, we undertook the job on November 18, 19 and 20, 1960, of entering into all the manholes and structures between Norfolk Street and Diagonal Way along East Marginal Way.

The inspection crew consisted of Edward D. Greathouse, Project Engineer and narrator of this report; Alice C. O'Byrne, Junior Civil Engineer; and Donald W. Gleason, Draftsman.

The operating procedure was for the writer to enter into the facilities, Alice O'Byrne to tend air line and keep notes, and Donald Gleason to tend the safety lines.

Photographs were taken of all manholes and in all structures entered. They are inserted chronologically through out the discussion of our findings.

We wish to thank the newly created City of Seattle's Sewer Division for their cooperation and specifically of their loaning us the necessary fresh air supply equipment.

The manhole designations are the same as the aerial survey target numbering and the intermediate manholes were lettered with capital letters.

The elevations mentioned in this report are Metro Datum plus 100 feet.

As a general comment, we strongly recommend that a vigorous attempt be made to instigate an adequate maintenance program whereby: (1) sand and gravels are removed as required to enhance

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the hydraulic flow characteristics of the existing 42-inch and 60-inch trunks and protect the existing and future pumping facilities downstream; (2) that the organic material and petroleum derivatives be periodically washed down off the walls of the manholes and structures; and (3) that a concerted study of the industrial discharges presently being dumped into the system be made and adequate controls be enforced so that volatile gas and inflammable materials are not discharged into the sewerage system.

The following pages contain the comments, description and photographs taken at the time of inspection of each facility.

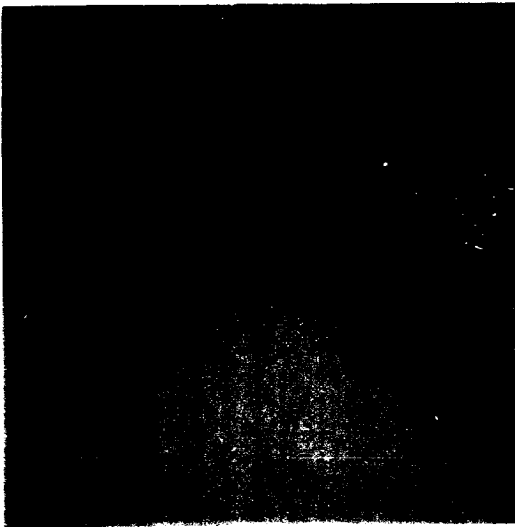
METROPOLITAN ENGINEERS

Edward D. Greathouse
Project Engineer

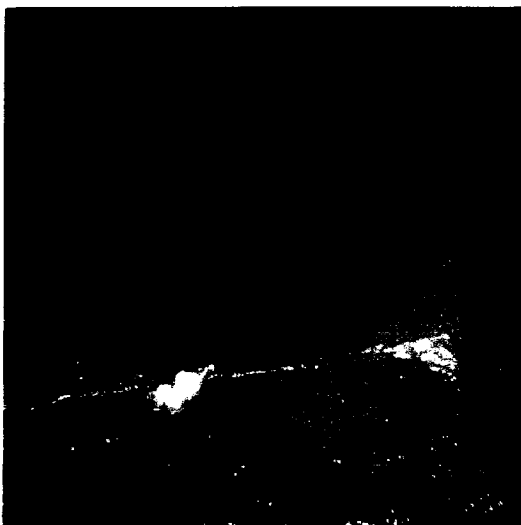
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November 28, 1960

The sewer overflow structure at Norfolk Street is located under the Boeing Aircraft Co. security fence east of East Marginal Way. First reading for elevation is taken to the crown of the 42-inch pipe on the westerly edge of the overflow structure (Elev. 109.08, thence invert is Elev. 105.58). The 42-inch channel is observed as being approximately one-half full of sand and gravel and with a shovel it is impossible to dig down to the invert. Second reading is on the weir wall at the west edge of the structure (Elev. 108.18). The third reading is on the water level in the 42-inch pipe at the west wall and the depth and time is recorded in the field book (Elev. 107.78 at 9:38 a.m.). The fourth reading is on the top of the disturbed sand and gravel that is the flow line of the north channel (Elev. 106.78). The water level in the 42-inch channel on northerly side of the weir wall is 0.4 feet below the weir crest at the west edge of the structure. The weir wall is 12 inches wide and it is observed at 9:45 a.m. that the 84-inch overflow out of the southerly half of the overflow structure is empty.



Photograph No. 1 - Standing under the manhole opening in the northwest corner of the structure and snapped the photograph looking easterly along the weir wall.



Photograph No. 2 shot from the same position looking southerly over the weir wall into the side face of the 84-inch pipe overflow opening.

The crown of the 84-inch pipe out of the overflow structure, draining westerly, is 0.55 feet below the west end of the weir (Elev. 107.63) and thence 84 inches down to the invert (Elev. 100.63). Appearance of the concrete inside the structure is good, no apparent deterioration, spalling or rock pockets. The standing water level in the 84-inch overflow pipe at the west wall is 0.8 feet deep. General slime and crud in the channels and the walls are very slippery, no noticeable petroleum products, asphalt or tars. Took an elevation on the weir at the east wall of the overflow structure (Elev. 108.22) and in the channel of the 84-inch inflow line at the east face of the structure (Elev. 106.27). The water level was 0.4 of a foot down from the weir elevation and the depth of flow was 1.55 feet deep.



Photograph No. 3 - Taken from a point 25 feet \pm E. of the west wall looking along the channel into the 84-inch inflow line. Weir is on the right with manhole steps on east wall leading up to existing opening.



Photograph No. 4 - Taken from a point 25 feet \pm W. of the east wall looking into the 84-inch pipe opening of the outfall line.

In reference to the grit mentioned before, the sand and gravels in the 42-inch outlet channel do not continue up the 84-inch line coming into the structure and it is relatively clean at the flow line. Therefore, there is apparently a buildup of sands and gravels along the flow line of the north channel from the east to the west; this might be due to downstream channel conditions in that we know that there are pipe restrictions below and bad channelling in a manhole below where a 90° turn is made.

Manhole A

Manhole A needs to be completely rebuilt. Brush, boards, sticks and debris are piled up against the entrance to the 20-inch tubes on the outlet side of manhole A - I cleaned it out. The 36-inch line entering from the south has about 0.8 of a foot of sands and gravels in the bottom and the water level as of this time, 10:40 a.m., is 0.8 of a foot down from the crown of the pipe.



Photograph No. 6 - Looking north down into the manhole.

The entire manhole will have to be replaced, including the line from the 90° turn down to this manhole and the two 20-inch tubes that drain northerly from manhole A.

Manhole B

The 20-inch pipes entering the manhole from the south with a 42-inch reinforced concrete pipe going outward on the north. Water level is 1.10 feet below the crown of the 42-inch pipe; 2.70 feet down to the top of the sand and gravel in the invert.



Photograph No. 7 - Looking north down into the manhole.

Entire manhole will have to be rebuilt when the new 42-inch connecting line from manhole A is installed to replace the two 20-inch pipes to the south.

Manhole C

About one inch of very fine silt on the ledges on both sides of the manhole. Measured down from the crown of the entering pipe on the south, 0.8 feet to the water level and 2.6 feet down to top of fine sand in the invert. Cannot feel of any rocks or gravel - just fine sand, a sample of which is black in color and sticky. The ledges are suggested to be filled or sloped on both sides. The manhole apparently was constructed by laying the pipe through the manhole and breaking the top of the pipe out with a 2-foot linear opening across the manhole base. Edges are ragged, apparently it was not plastered or smoothed up during construction.

Manhole barrel is dry, no weeping in the manhole blocks. Steps are rusty, however, in fair condition. Sides should be plastered.



Photograph No. 8 - Looking down into the manhole.



Photograph No. 10 - Looking west over weir at 42-inch outfall.

This entire area behind the weir can either be filled with concrete or we can just build up the weir wall to the roof height. The bottom of the roof over the overflow weir and the outlet portion of this reinforced concrete structure is .8 of a foot above the weir height. It is suggested that this old measuring device be removed, conduit plugged as it is all inoperable and probably has been for 10 or 15 years, and the pipe standard on which it sets does propose a means of blockage in the sewer. In the invert of the sewer are several large rocks, three to four inches in diameter, plus other miscellaneous sands and gravels of an estimated depth of about a foot.

Manhole No. 12

A good manhole, plastered inside, channelled up to the spring line. Has about a 3-inch ledge for placing the feet on both sides. I do not think that this manhole needs to be repaired. Water level had been up to 1.3 feet above the crown of the incoming and outgoing sewers as is indicated by the crud and debris on the side of the manhole. Manhole itself does not weep but has a plugged side sewer connection coming in from the west and has a live side sewer connected into the manhole from the east and the invert elevation is one foot above the springline of the 42-inch pipe. The invert of the manhole has approximately 0.1 to 0.15 feet of silt or cemented silts in the invert, however, the pipes coming in and going out, as far as I can go back, are clean, no debris, no sand.



Photograph No. 11 - Looking down into the manhole.

Manhole No. 13

Manhole generally in good shape, well plastered inside; flow at this time is right at the springline. The shelf on both sides is slightly submerged by one-quarter to one-half inch of flow. Maximum indicated water level in the sewer has been 1.3 feet above the crown of the incoming 42-inch line.



Photograph No. 12 - Looking down into manhole.

Invert is a little rough near the outgoing edge of the manhole, however, not too bad. There is no sand, silts or debris in the manhole, nor in the pipe lines on the north or south.

Manhole No. 14

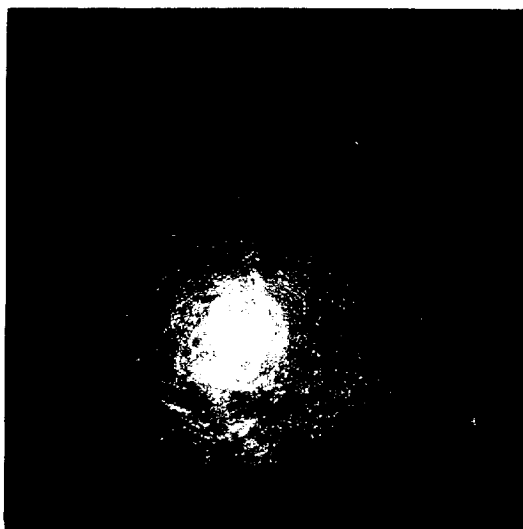
The 42-inch pipe running from south to north is completely encased in concrete and has, in effect, an inverted siphon running underneath it carrying storm flow from the east to the west. Size of the outgoing pipe to the west is 33-inch in diameter. The top of the bottom slab of this manhole, which is roughly 8 feet long in the north-south direction and 9 feet wide in the east-west direction, is 6 feet below the top of the encased 42-inch. The bottom of the encased 42-inch is rounded, however, the bottom of the entire manhole (which is trapezoidal in shape in the plan view and rounded at the corners) has a square edged bottom and has considerable sand, rock and gravel. Oil slick and scum is trapped on the water surface in the incoming line to the east and in the manhole to the east of the encased 42-inch. Sides of manhole needs plastering.



Photograph No. 13 - Looking east at incoming 36-inch sewer. Petroleum wastes on sides of manhole. Notice bottom step completely covered.



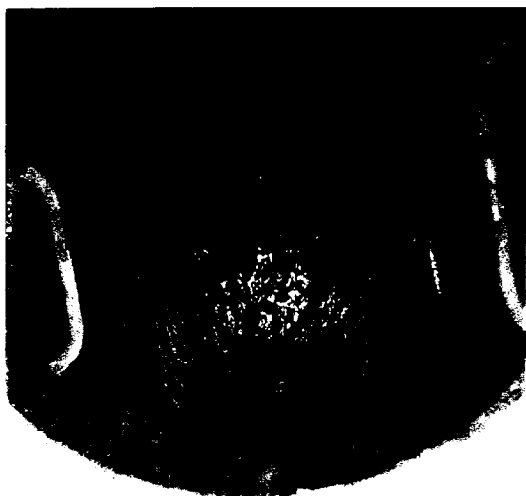
Photograph No. 14 - Looking westerly at 33-inch outlet pipe. Petroleum scum on top of encased 42-inch trunk.



Photograph No. 15 - Looking down into manhole. Flat top of encased 42-inch sewer with petroleum wastes. Scum is trapped on water surface on East side.

Manhole E

At 1:30 p.m., depth of flow is 1.85 feet below the crown of the outgoing sewer on the north side and 3.2 feet down to the top of the sand and gravel in the invert of the manhole. Considerable sand and gravel upstream and downstream is indicated by probing. Manhole is very dirty on the shelf and on the barrel up to 1.9 feet above the crown of the outgoing sewer to the north. The size of the sewer coming in and going out is 42-inch.



Photograph No. 16 - Looking down into manhole.

The manhole is plastered with mortar inside and is in good condition, manhole steps in good condition, however, the ring of the manhole at the top needs resetting because ground water and storm inflow is coming in from beneath the ring.

Manhole F

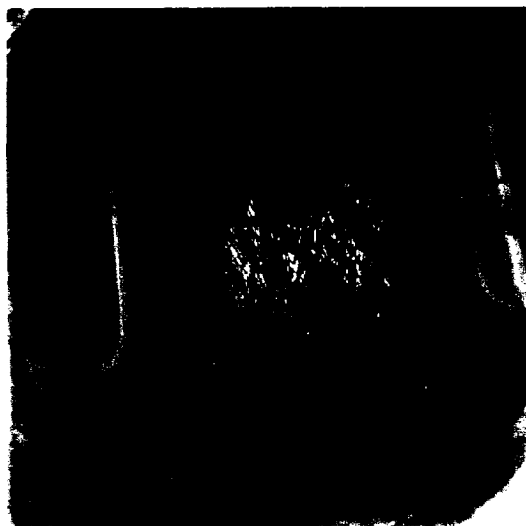
The flow is 1.4 feet below the crown of the incoming 42-inch on the south edge of the manhole. Crud and debris clinging to the sides of the manhole up to 8 feet above the invert grade, manhole plastered, in good shape, smooth surface, however, does need cleaning. Measured 2.60 to top of sand and gravel from the crown of the 42-inch on the south edge of the manhole.



Photograph No. 37 - Looking down into manhole.

Manhole No. 15

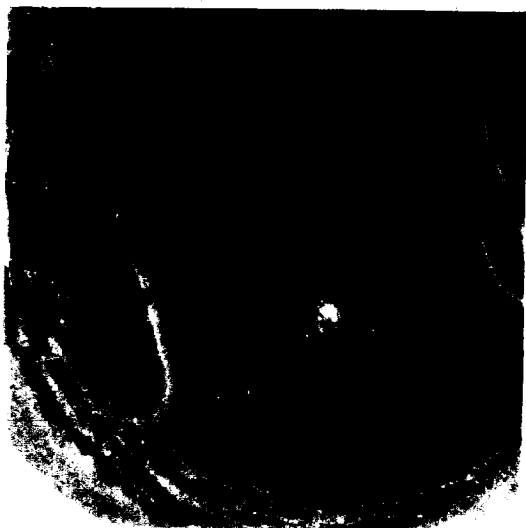
The condition of the plaster inside the manhole is good, invert is clean, flow is running very fast, the water level in the sewer is 2.4 feet down from the crown of the outgoing sewer to the north. The maximum water level, as indicated by the debris, inside of the manhole is 2.9 feet above the crown of the 42-inch sewer.



Photograph No. 17 - Looking down into manhole.

Manhole G

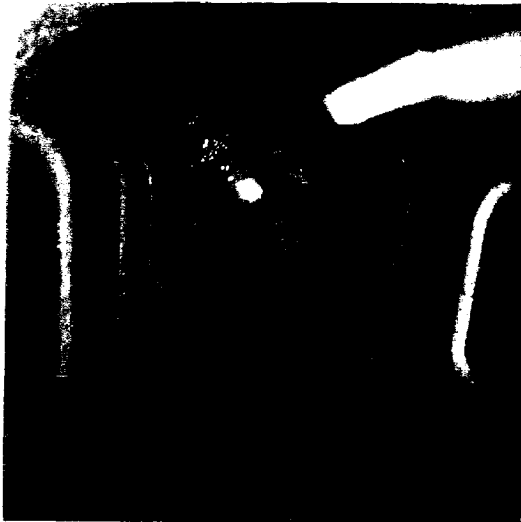
The flow is running higher in this sewer being 1.1 feet down from the crown of the incoming sewer to the south. The manhole is plastered in good condition, however, the sewer and the manhole shows signs of having many back-ups. Debris and crud hanging on the sides of the manhole to 4.2 feet above the crown of the incoming 42-inch sewer.



Photograph No. 18 - Looking down into manhole.

Manhole AA

Inside the manhole is plastered in fair shape, manhole rungs are also in fair shape. The water level is 0.8 feet below crown of the outgoing 42-inch pipe to the north at 2:10 p.m. The invert is clean, no sand and gravel can be felt with probing. Maximum water level, as indicated by the debris clinging to the sides of the manhole, is 4.9 feet above the crown of the outgoing 42-inch pipe to the north. In addition, fine silt is clinging to the sides of the manhole, up some 4.8 or 4.9 feet above the crown of the outgoing sewer pipe, and also occurs on the shelf and on the ends of the pipes that stub into the manhole.



Photograph No. 19 - Looking down into manhole.

Manhole No. 16

The water level is at the crown of the 42-inch pipe on the north side. There is an 8-inch pipe stubbed into the manhole on the north side, from the west, 90° to the 42-inch pipe. Flow line of the 8-inch pipe is 1½ feet above the crown of the 42-inch. Mud, silt and debris clinging to the sides up to 2 inches deep on the ledge and up to 3 inches deep on the manhole steps. Velocity of the sewage at this point is practically nil, lot of flotsam on top. However, by probing cannot find any sand and gravels on the flow line at invert grade. There are two pieces of steel sticking out from the wall, on the north side of the manhole, one about a foot above the crown of the 42-inch pipe



Photograph No. 20 - Looking down into the manhole.

and the other about 3 feet above the crown. They stick out about 2½ to 3 inches - should be cut off and the inside finish smoothed up. In looking down the 8-inch pipe that stubs into the manhole on this north side, it was observed as being about from 1/2 to 3/4 full of silt from the face of the manhole back for 12 joints that I can count. Apparently the line is dead, this should be checked and if it is a dead line it should be capped and plugged. The manhole up near the top, to about 3 feet below the bottom edge of the ring, should be plastered and smoothed up. Ground water table has been leaking through the mortar between the bricks.

Manhole I

Water level is 0.4 feet above the crown of the 42-inch incoming sewer on the south side of the manhole. Manhole is very cruddy, deep with mud on all the manhole steps and clinging to the sides. The velocity is very slow, a lot of flotsam on the water surface. Maximum water level as indicated by the crud on the sides has been to 6 feet above the crown of the 42-inch on the incoming sewer on the south side of the manhole. Other than that, the manhole seemingly is plastered with mortar fairly well, the manhole steps are tight, however, the seal under the ring at the top of the manhole has been broken and the ring has shifted some - should be replastered and sealed up.



Photograph No. 21 - Looking down into manhole.

Manhole BB

Water level is one foot above the crown of the 42-inch on the outgoing pipe on the north side of the manhole. The manhole is crudded up to approximately $6\frac{1}{2}$ feet above the crown of the same 42-inch pipe. Paper, debris, and crud hanging is on the manhole steps - a lot of flotsam and slight turbulence in the sewage in the bottom of the manhole

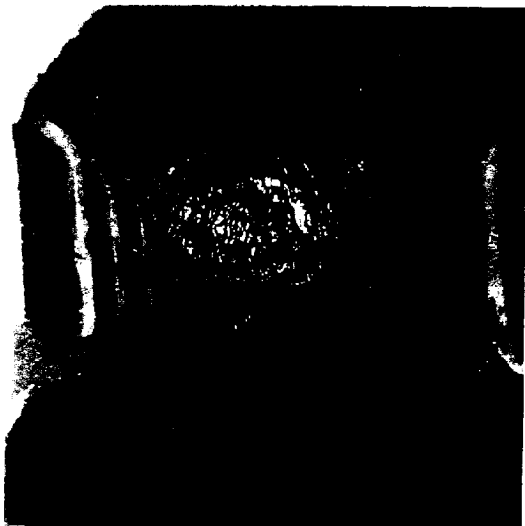


Photograph No. 22 - Looking down into manhole.

Velocity is not going through clean but is boiling and swirling in a backwater effect. Top 4 or 5 feet of the manhole needs plastering with mortar otherwise the plastering and manhole steps seem in fair condition.

Manhole No. 16A

Crud and debris in the manhole - clinging on the sides up to within 7 feet of the top of the ring. Soft sands were felt in the invert. Measured down from the crown of the 42-inch pipe coming in from the south, one foot even to water level and thence again measured from the crown of the 42-inch on the incoming pipe on the south side of the manhole down 2.7 feet to the top of the sands and gravels in the bottom of the pipe. This manhole is in pretty poor condition inside, needs plastering on the inside, visible infiltration between the bricks up to $2\frac{1}{2}$ feet above the crown of the 42-inch pipes, can hear a leak or a side sewer coming in either upstream or downstream from the manhole, cannot tell. Should check the side sewer cards for a connection in this area.



Photograph No. 38 - Looking down into manhole.

Manhole No. 17

A lot of heat coming out from the manhole, very warm, had to use the air equipment, crud hanging on the sides of the manhole up to within about 7 to 7½ feet of the top; measured 1.0 feet down to the water level from the crown of the 42-inch at the south side of the manhole. Globules of silt and fatty substances hanging on the sides of the manhole up to 4 or 5 inches thick. Manhole steps completely obscured by the silts and crud - had to scrape from around the steps before I could get down to the bottom. Can hear a large flow of water into the pipe from the south, possibly the same flow that was heard from manhole 16A; this should be checked out on the side sewer cards for Boeing connections.



Photograph No. 40 - Looking down into manhole.

Manhole No. 18

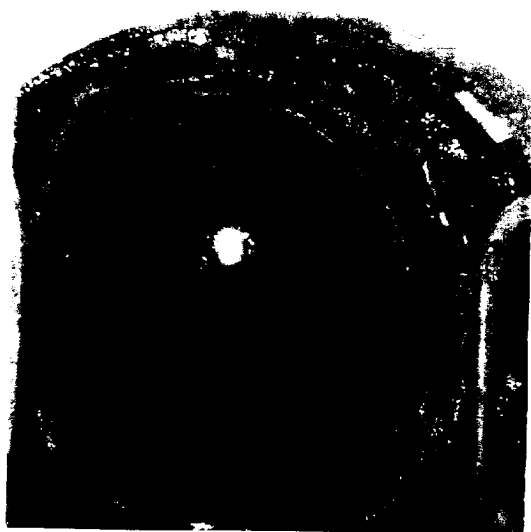
Manhole is right in front of a hardware store known as Aircraft Tool House. Manhole No. 18 was measured 5 feet from center of manhole to the face of the building of the Aircraft Tool House. Bad smell in the manhole - used the air equipment. Manhole needs plastering all the way down to the springline of the sewer. Measured the water level at 0.4 feet below the inside of the bell of the sewer going out to the north. Measured 12.24 feet down to the inside of the bell at the top of the 42 of the outgoing north-end sewer. Two adjusting blocks missing under the ring.



Photograph No. 39 - Looking down into manhole.

Manhole No. 19

This is the manhole that is southerly of the turn that deflects to the left, goes westerly across East Marginal Way; the manhole is in very poor shape, the water level is right at the crown of the incoming 42-inch line from the south. Manhole needs plastering; debris and solids are clinging to the wall up to within 6 feet of the top and from a point 5 feet down from the top there is mold all over the sides of the manhole.



Photograph No. 41 - Looking down into manhole.

Depth of flow was such that no attempt was made to determine the depth of the sand and gravels that occur in the invert of the sewer.

Manhole No. 21

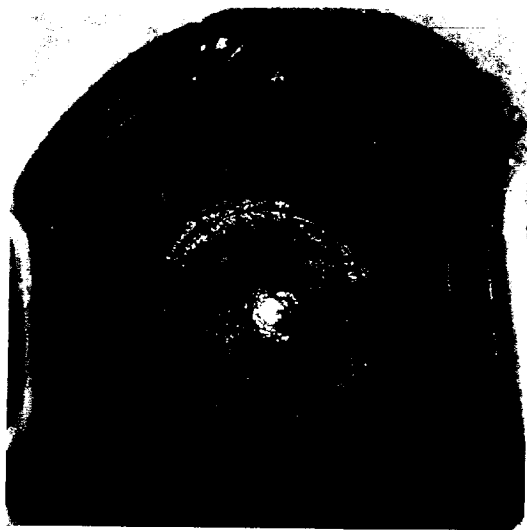
The manhole, just south of the existing lift station, measured 7.15 feet down from the rim to the invert of the bypass line that goes out into Waterway No. 4. The bypass piping at this point is 30 inches in diameter and has a weir buildup one foot down the pipe from the face of the inside of the manhole. This weir being 0.65 feet high to the crest above the invert of the 30-inch.



Photograph No. 42 - Looking northwesterly down 30-inch bypass - weir shown in foreground. This weir keeps high tide from backing up into sewer.

In the 30-inch bypass line, the first joint is mortared up with about 0.10 feet annular space between the spigot and the face of the bell, however, in the second joint, from the manhole, the joint has been pulled about .3 of a foot at the top, thence filled with mortar and at the third joint the spigot is separated from the bell about 10 inches with only the bottom half mortared up. The top half is opened back in 0.3' or to 0.4' and then there is

broken soft mortar back above that. From there on, northwesterly inside the 30-inch line, the joints are pulled from $1\frac{1}{2}$ to 3 tenths of a foot, fairly well mortared up to the springline, very poorly mortared at the top.

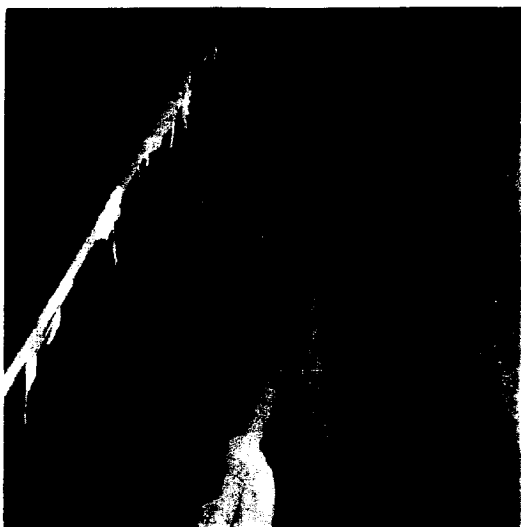


Photograph No. 43 - Looking down into manhole - bypass line on upper left.

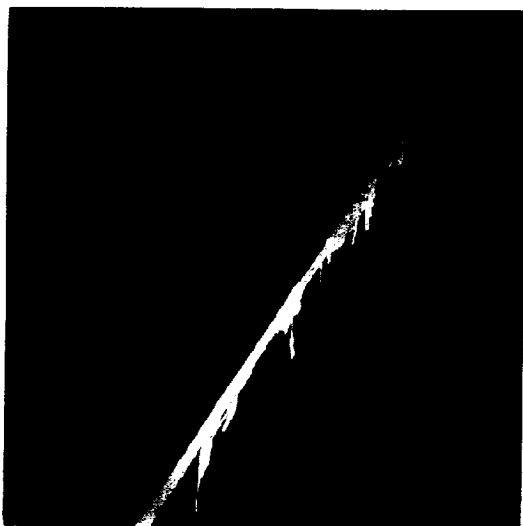
We then measured from the invert of the 30-inch bypass piping down to the bottom of the manhole at 11.32 feet deeper. Could not locate by probing the Boeing side sewer that is supposed to be connected to this manhole from the east. Water level in the manhole approximately 4.5 feet above the invert of the 42-inch.

Manhole No. 22

Manhole No. 22 is the entrance into the wet well of the existing pump station. Down in the wet well there is a fresh water supply hose hanging on a hook on the side of the manhole but from the crud and debris in the wet well it does not look like it has ever been used. Half way back in the wet well chamber, there is a conduit hanging down, with a light bulb in one of the outlets, laying down across the water pipe. Apparently the cinch anchors into the roof of the structure have let go and let the conduit drop down. There is a ledge along the east wall of the wet well chamber - crud and debris to about 3 inches thick on it. There is a guard rail along the pit side. Along the north wall of the wet well is a ladder made of straps and pipe crossing it entering down into the flow. I measured the length of the wet well at $29\frac{1}{2}$ feet, as close as I could and was unable to measure the width, but would estimate it at about 12 feet wide. Took three pictures in the wet well, two in the northerly direction from underneath the access shaft and one from back in the chamber looking back towards the entrance of the access shaft, thence measured 6.15 feet down from the rim to the bottom edge of the roof slab of the structure and measured the thickness of the roof slab of the structure as being 1.33 feet thick. Manhole ring needs reset and mortared.



Photograph No. 44 - Looking northerly along East wall - electric conduit with light bulb on upper left - lower right shows ledge and handrail - ladder down into sewage in background.



Photograph No. 45 - Looking northwesterly. Conduit laying down across fresh water line - 1-ft. weir between top of north wall and bottom of roof slab not visible in background. Water level indicated by rags and paper on conduit.



Photograph No. 46 - Looking southerly from back on ledge. Access ladders shown - along wall on left is fresh water piping - hose coil shown in upper center.

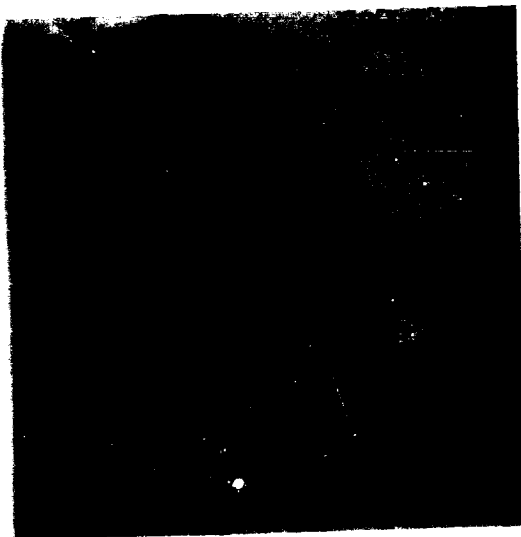
Manhole J

Thirty-inch pipe bypass or overflow comes from the southwest on a curve apparently around the lift station on the west side and into this manhole. Thirty-inch pipe is 4-foot joints, first three joints out of the manhole are in good shape, plastered inside, and smooth flow lines. Fourth joint has got a break in the flow line of about a tenth displacement of the spigot from the bell flow line and the fifth joint is displaced the full thickness of the spigot of the 30-inch pipe. In the middle of the barrel of the sixth pipe, southwesterly up the 30-inch line is a 45° mitered joint to the right. Thence it goes for approximately 15 feet in a reinforced concrete box with the 30-inch width filleted on both sides of the flow line and with a squared top. Measurements from the flow line to the bottom edge of the top slab is 30 inches. At the most westerly end of this chamber, at right angles to the left, is a 30-inch pipe stubbed into the side. At the fifth joint out of the manhole upon crawling back in the pipe and found a triangular shaped piece broken out 2 foot wide at the face of the spigot end of the pipe and was cracked back 1½ foot deep on the perpendicular, forming a triangle. It appears from the displacement of the joints that there is differential settlement between the pipe line and this reinforced concrete box structure. Now back in the manhole, along the southerly edge of the manhole, there is a 36-inch pipe coming in at about 6-inch spacing between the edge of the 30-inch and the edge of the 36-inch pipe. This 36-inch pipe runs parallel to East Marginal Way in direct line with the manhole 22, which was the entrance into the wet well.



Photograph No. 49 - Looking down into manhole "J"- 36-inch bypass from wet well on lower right. Thirty-inch bypass around station on lower left. Mud and debris visible in bottom of manhole.

Up in this 36-inch pipe, the first joint is pretty fair, match flow lines are acceptable. The mortar in the annular space is full, however, has slight cracking. At the end of the second joint is the face of a trapezoidal chamber going into the wet well of the lift station. The joint to the wall has cracked or been pulled at the top a half inch, however, we can see through the crack and see a concrete collar on the outside. Slight drip of infiltration but not too bad. Because of the darkness in the wet well, as reported from manhole 22 yesterday, I could not see the one foot clearance between the bottom of the top slab of the wet well and the top of the north wall where there is a one foot clear space forming an overflow weir whereby the water level in the wet well could rise to one foot below the bottom of the top roof slab thence over the weir into this trapezoidal chamber to the 36-inch line which would go to the overflow. This trapezoidal chamber has a 12-foot perpendicular dimension from north to south. The dimension at the face of the lift station is approximately 12 feet the same as the width of the wet well thence necking down to a 6-inch clear distance on each side of the 36-inch pipe. The top of the chamber is at the same elevation and a continuance of the top roof slab.

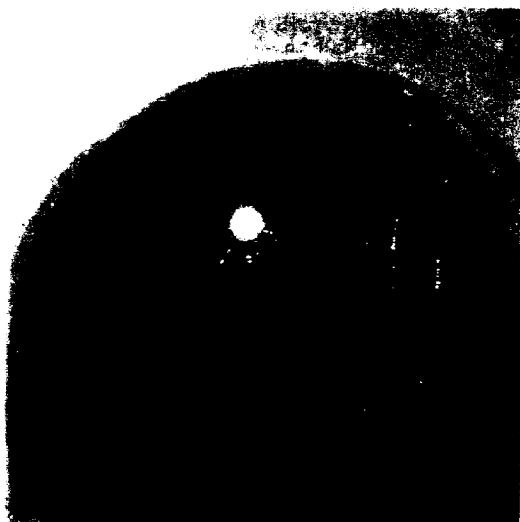


Photograph No. 48 - Looking at 36-inch opening from weir on north wall of wet well of existing lift station.

Back in manhole "J" looking northerly, parallel to East Marginal Way, is a 36-inch pipe going out to the next manhole on the bypass line. The joints as far as I can count them back are in acceptable condition, the flow lines match fairly well and the mortar appears to be in all joints. This manhole is of brick type down to about 2/3 the depths of the pipe where it has a small shelf on each side for foot positioning, however, the roughness of the barrel from the springline up to the ring and cover is very rough and should be plastered.

Manhole K

The bypass line, which is 36 inches in diameter, drains in from the pipe to the south and which is essentially parallel to East Marginal Way thence drains northwesterly at an angle point made in the manhole out to Waterway No. 4. Tide level has backed up into the bypass line at this point and is at the springline of the pipe.



Photograph No. 50 - Looking down into manhole.

Manhole L

Manhole L is the manhole approximately 15 feet northerly of manhole K and closer to the edge of East Marginal Way. This manhole is also the end of the discharge of the 20-inch force main coming out of the existing lift station at waterway No. 4. On the south face of this manhole, there is one length 8 feet long of 42-inch reinforced concrete pipe with a brick and mortar bulkhead in it and the 20-inch force main comes out in the center of this bulkhead. The water velocity in the manhole channel is too fast to stand up in and the water level is approximately .8 of a foot deep. This was determined by measuring down from the crown of the 42-inch, thence the flow gets quite turbulent and drains northerly in the 42-inch pipe for approximately $3\frac{1}{2}$ to 4 lengths of pipe, thence goes into a hydraulic jump probably caused by rocks or debris in the invert. Farther downstream the water level smooths out and then I cannot see any more.



Photograph No. 51 - Looking down into manhole - velocity very fast.

Both manholes K and L need the brick to be plastered on the inside of the manhole from the top of the pipe on up to the bottom of the ring. Both manhole rings and covers are approximately 18 inches below the driveway surface therefore should be adjusted for easy maintenance and access.

Manhole No. 23

Two and a half bricks are missing just beneath the ring, a piece of 2 x 6 lumber showing in the hole with grass and roots growing around it. The sides of the manhole are red in color which appears to be iron oxide all the way from the ring down to the springline of the sewer. The water level in the sewer is 2.2 feet down from the crown of the 42-inch pipe coming in from the south. Both pumps in the pump station are on. Therefore the water level in this sewer at the grade that was indicated on the plans will give us an idea of the combined discharge rate of both pumps. Inverts are smooth, however, the sides of the manhole from the springline on up to the top should be plastered as it is very rough and ground water is infiltrating in between the bricks.



Photograph No. 52 - Looking down into the manhole.

Manhole No. 24

The manhole is bricked all the way down to approximately 6 inches above the invert. Only the bottom portion is plastered smooth but from about 6 inches above the invert grade up to the top is just rough bricks. This manhole should be plastered and cleaned up. Ground water infiltration running in between the bricks from approximately the top of the pipe on up for three feet. The manhole rungs have a heavy scale on them which is flaking off, some of these should be removed. Depth of flow is 2.10 feet down from the crown of the 42-inch pipe on the south face of the manhole.



Photograph No. 53 - Looking down into manhole.

Approximately 1-1/3 joints northerly of this manhole there is a side sewer 8-inch in diameter coming in from the west. The pipe barrel of the 42-inch is cracked out around this pipe and very poorly mortared. The 8-inch pipe protrudes inside the 42-inch pipe approximately .3 of a foot. No flow is coming in the 8-inch pipe, however, there is slight weeping all the way around the outer edge of the 8-inch pipe.

Manhole No. 25

This manhole is a brick manhole with mortared joints - ground water is infiltrating - should be plastered up. Manhole steps here have more than usual rust scale on it. Out of the manhole barrel from the west protruding out into the opening is a piece of 3/4-inch reinforcing bar sticking out $3\frac{1}{2}$ feet and which apparently was left here during construction. The flow line again is only plastered in the very bottom and the rough bricks are brought up from about 6 or 8 inches above the invert on up through the barrel - should be plastered and cleaned up. The sewer is relatively clean, no sand and gravels can be felt in the invert.



Photograph No. 54 - Looking down into manhole.

Up 4 or 5 joints to the south there is a side sewer coming in - looks to be 8 or 10-inch pipe protruding in an estimated 0.3 to 0.4 of a foot inside the 42-inch pipe. Heavy flow is coming in from the side sewer at 11:06 a.m. The flow at this point is 2 feet below the crown of the 42-inch pipe coming in from the south. There are three adjusting blocks missing immediately beneath the ring of this manhole and pieces of broken concrete, grass and roots can be seen through the opening.

Manhole No. 26

The description of the brick carried down to approximately 6 inches above the invert grade is the same as for manhole No. 25 - needs plastering - ground water is infiltrating - steps are badly scaled, however, still solid.



Photograph No. 55 - Looking down into manhole.

The bricks that lap over into the bell section of the pipe leading to the north is partly missing and filled with sand and solids. Depth of flow is 2.10 feet down from the crown of the 42-inch sewer coming in from the south.

Manhole M

Brick manhole same as in 25 and 26 except that the plastering of the invert has been carried up to the springline. No ledge on either side. The groundwater is infiltrating in between the brick into the sewer - manhole should be plastered. More scale is being observed on the manhole steps the further north we go. They are still solid, however, should be removed for future safety.



Photograph No. 56 - Looking down into manhole.

Depth of flow or the water level is measured 2.15 feet down from the crown of the 42-inch sewer coming in from the south.

Manhole No. 27

Different type of construction in that they probably used a poured base up to the top of the pipe and then came up with brick and mortar. The mortar is completely gone between one row of bricks for half the circumference of the manhole barrel, approximately 5 feet down from the surface. Ground water has been infiltrating; the water level in the manhole has been considerably higher as indicated by the debris and solids clinging to the sides of the manhole.



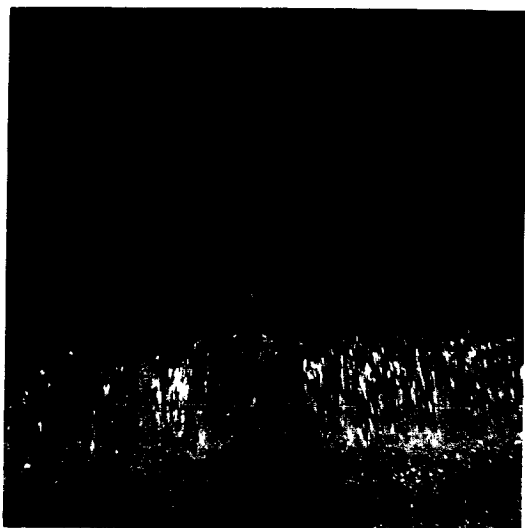
Photograph No. 57 - Looking down into manhole.

Manhole No. 28

Manhole No. 28 is the last manhole on the 42-inch line before going into the Michigan Street trunk. The center of the manhole lid and cover is 2 feet out from the curb on the down ramp from the First Avenue South bridge. There is a crack in the new curb along the southerly edge of the ramp just opposite the manhole ring and cover. Pavement shows a few hairline cracks that do not appear to be deep or serious, however, the crack in the curb is very apparent in that it is a new curb. The top three manhole rungs and one rung opposite the top rung are badly corroded, in very poor shape and should be removed. The manhole itself is brick down to 1/3 the depth of the pipe above the invert with no plaster. If this manhole is maintained in the final planning it should be plastered to a smooth finish.

Manhole N

At the Michigan Street regulator structure. On opening the manhole lid, the smell of strong petroleum and other wastes were very strong - used air equipment that was borrowed from the city of Seattle. Equipment worked very well and was able to get down into the Marginal-Michigan Street trunk. Flow was .2 of a foot over the weir.

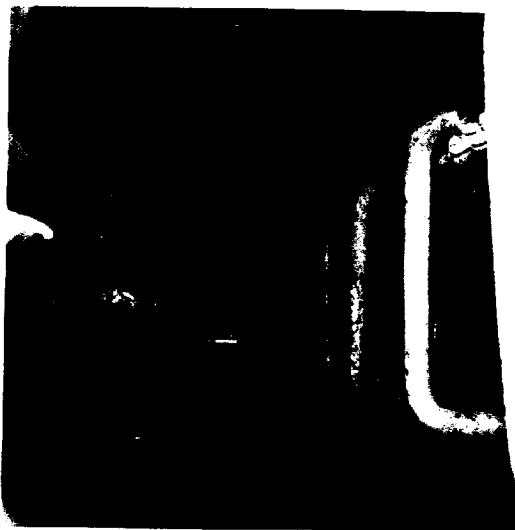


Photograph No. 31 - Looking easterly toward weir in 70" x 102" Michigan trunk.

Took two readings measuring down from the manhole ring at 11.0 feet down to the invert of the trunk at this point and 9.30 to the top of the weir. Concrete was observed as being in good condition, no spalls, rock pockets, etc. Scum is quite a problem, being 0.15 to 0.2 of a foot thick up to about 2/3 of the pipe depth above the invert. No sand and gravel or grit, access manhole to structure at manhole end needs plastering on the upper section, ground waters are weeping in. Also observed behind the weir in the horseshoe shaped trunk, the same general type of channelling to the side outlet that occurred in the Brandon Street trunk.

Manhole O

In manhole O, the regulator structure, we measured 13.10 feet to invert of 24-inch pipe going out on the north side of the chamber. The flow is very fast and turbulent in the bottom of the chamber. It has a flat bottom and we had a reading of 12.60 feet in the southeast corner on the bottom just below the cast iron orifice.



Photograph No. 33 - Looking down into regulator structure - orifice with cast iron radial gate type shutoff in open position - 24-inch pipe drains out at upper part of chamber - cable from gate up to sheave is on left.

Manhole P

Manhole P is the float chamber for the regulator machinery. Machinery again in this picture on the shafts and at the bushings has Alemite fittings; the cable is stranded in one place. The float is two $1\frac{1}{2}$ pieces of 8 x 8 x 16 concrete block laying on it plus an undetermined amount of chain such that the float position is riding rather low in the water. The water level is the same as is in the horseshoe shaped trunk adjacent.



Photograph No. 32 - Looking down into float chamber - float with 2 lengths of chain and concrete blocks visible at bottom. Tell-tale hole from trunk comes in at lower right. Grease fittings on shaft pillow blocks do not appear to have been serviced recently. Petroleum slick visible by reflection on water around the float.

Manhole Q

Manhole Q is the discharge end of the 24-inch pipe coming from the Michigan Street regulator structure. This manhole has a 24-inch pipe coming in from the south and a 24-inch pipe going out to the north-northwest. The bottom 5 feet above the ledge which is at the crown of the incoming 24-inch pipe from the south is a poured-in-place or precast manhole section. The balance of the manhole up to the surface is brick with no plaster on the inside. The ring and cover is about one foot below existing grade and should be adjusted. On the easterly side of the manhole there is a blanked off opening and channelling for an approximate size 12-inch pipe for a future stub into this manhole. There is a board spanning across the manhole from the step on both sides of for maintenance purposes and is not necessary and should be removed.



Photograph No. 34 - Looking down into manhole.

Manhole R

Manhole R is on the 60-inch line. Upon opening the manhole, gas was smelled so we used the air equipment, went down, found several large rocks up to 6 inches in diameter in the invert of the sewer. In the line to the south, was measured 15 feet south from the edge of the inside face of the manhole to the end of the 60-inch where there is a bulkhead with the 24-inch pipe coming in on centerline of the 60-inch and with matching flow lines.



Photograph No. 35 - Looking southerly from manhole "J" - 24-inch line visible through bulkhead.

Manhole S

Manhole S is a poured-in-place manhole, very water tight, however, the ring has slipped on the top cone, no adjusting blocks and the ring should be reset. The sewer is running at a water level of 3.4 feet down below the crown of the 60-inch pipe going out to the north. There is approximately 0.3 of a foot of sand and gravels down in the invert of the sewer.



Photograph No. 58 - Looking down into manhole - ledge visible at upper right where ring has shifted on the cone.

Manhole No. 29

Manhole No. 29 is northerly of the First Avenue South up-ramp. Manhole base is poured to approximately 2 feet above the top of the pipe and thence it is bricked with plaster on up - very good condition. No sand and gravel in the invert. Water level is 3.35 feet below the crown of the incoming 60-inch sewer. Surges or pockets of gas is noticeable coming in from the south.



Photograph No. 59 - Looking down into manhole.

Manhole No. 32

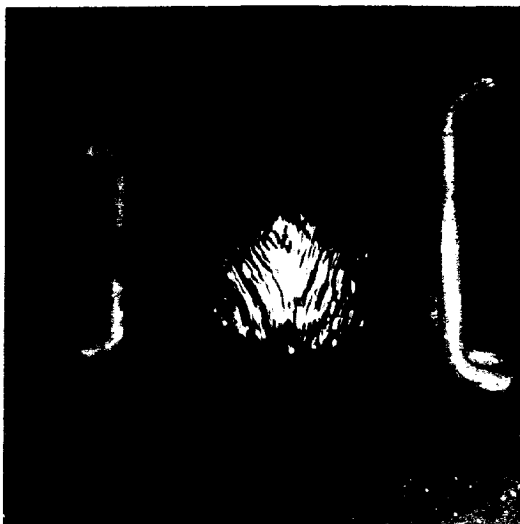
Upon uncapping it and going down in 4 or 5 feet, strong odors of a pungent gas was noticeable and had to come out to get the air equipment. Upon standing at the surface and then smelling slight wisps of it, it smells like gasoline or cigarette lighter fluid. This manhole is at the northeast corner, 15 feet out from the Northwest Glass Company office building. With the air equipment on, I went down and measured the invert grade from the top ring at 15.30 feet, observed the clay liner plates from the springline of the pipe over the crown on both sides. Invert clean, no sand and gravel, cannot hear any side sewers or flow coming in either to the north or south so cannot tell where this gasoline or cigarette lighter type smell is coming from. This manhole is right across from L. H. Butcher Company where there are hundreds of 50-gallon drums stacked in the yard - possible source of this pungent odor and gasoline type smelling fluid.



Photograph No. 62 - Looking down into manhole.

Manhole T

On the 60-inch line in a manhole directly east of the Brandon Street regulator structure. The 60-inch line is running with a fairly clean invert - quite a bit of smell at this point; have measured down from the rim 16.10 feet to the invert at the north side of the manhole. Condition of the manhole is good, the plastering is smooth, manhole steps are fairly tight, no apparent weeping or infiltration into the manhole. Manhole ring and cover need adjustment to a higher elevation so that storm inflow will not come in around the lid. Measured 3.40 feet from the crown of the 60-inch pipe down to the water surface, also measured back up from the water surface 5.8 feet to the highest water mark as identified by the debris on the steps on the side of the manhole.



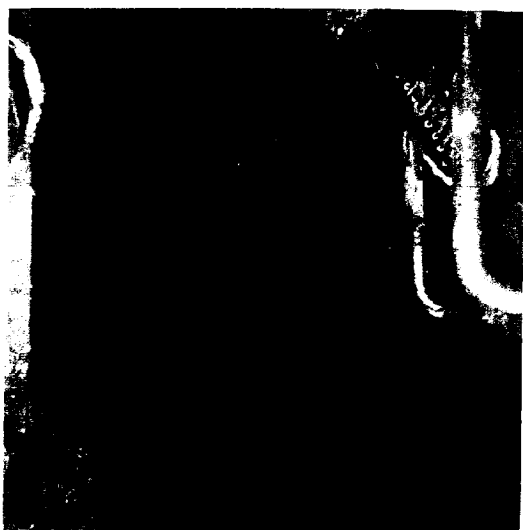
Photograph No. 30 - Looking down into manhole.

Manhole U

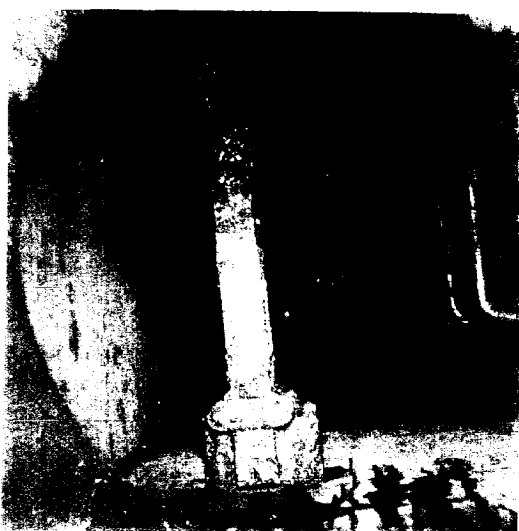
The finished I.D. of the horseshoe shape trunk to the west is 48 inches high by 80 inches wide. Horseshoe shape has a flat bottom of 4 feet 6 inches before the corners are curved upward on radius. There is a weir across the invert of the horseshoe shaped tunnel 3.60 feet from the inside face of the west wall to the east face of the weir along the invert. The flow is 0.1 feet deep in the horseshoe trunk easterly of the weir at the invert. In measuring vertically down from the top of the rim where we have an elevation in the field book for this project, we measured 11.54 feet down to the top of the weir. The invert to the west of the weir is 0.45 feet down from the top. Just east of the weir, crosswise, running in a north-south direction, is a channel practically 3 feet wide, sloped from the south to the north leading into the outlet orifice through the regulator chamber. In the reconstruction of this chamber the weir wall can be chipped out, the telltale hole over to the float chamber can be plugged and the channel on the easterly side of existing weir wall can be grouted full to a new outlet cut through the wall. The general condition of the concrete is very good, however, there is a considerable amount of asphalt, tars, etc., up to the crown of the pipe. The form marks in the concrete are still protruding out, not bad, however, does indicate that there has been good ventilation in this part of the sewer.

Manhole V

Manhole V is the float well of the Brandon Street regulator. The float well is silted up clear to the top of the float, the guides are crudded up, I doubt if they have moved in several years, all the shafts at the bushings have Alemite fittings which are plugged and have not been cleaned or used for a long time. The concrete as observed in the regulator structure immediately to the east of this chamber and the float chamber itself is in good condition. All the regulator equipment and the floats can be taken out and removed by loosening nuts on the anchor bolts, etc. The top slab is one foot thick and appears to be in good condition and I believe that if there is proper steel reinforcement that we can take out the internal wall between the float chamber and the regulator chamber with no difficulty. The dimensions are the same as those that are shown on the plan, the manhole steps, etc., are in good shape. Might be also worth reporting that the telltale hole between the horseshoe shape Brandon Street trunk and this float chamber is all plugged up. There is no way for flow to get over into this float chamber in its present condition. In trying to loosen it up with my foot, I found that it is packed rather solid and I cannot get it loose. In its present condition, it would be impossible for the Brandon Street trunk regulator to ever close off completely. The flow is somewhat restricted in that the regulator gate is in about a half closed position right now; it is not in the full open position.



Photograph No. 28 - Looking down on float partially submerged in mud - telltale hole at upper left is packed closed.



Photograph No. 29 - Looking down from the top - sheave, shaft and pillow block assembly on left.

Manhole W

Manhole W is the outlet of the regulator structure with a 12-inch pipe going to the north invert 12.97 feet down from the rim. Time is 9:30 a.m., the flow is being diverted entirely from the Brandon Street trunk to the 60-inch Diagonal Avenue trunk. Second measurement was from the bottom of the floor near the cast iron regulator gate structure at the south wall and we measured 11.77 feet down below the rim. By probing, we find that the bottom is generally flat with a slight amount of dish-ing toward the invert of the 12-inch pipe.



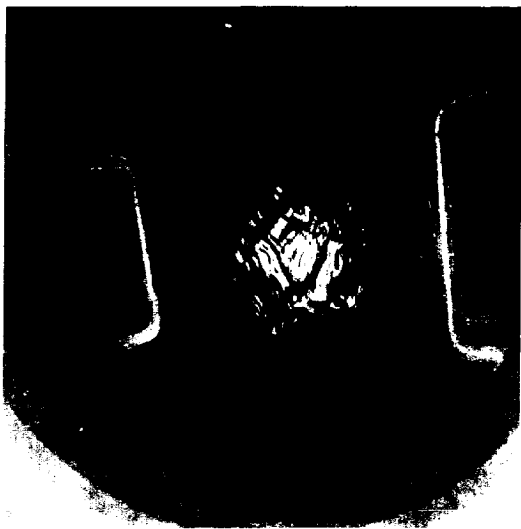
Photograph No. 26 - Looking down at existing flow out of regulating orifice - 12-inch pipe out to north is visible - entrance losses evident by ponding, etc.



Photograph No. 27 - Looking down from the top - sheave, shaft and pillow block assembly shown. I cleaned off the top of the grease fitting so it would show.

Manhole No. 33

Gas is getting worse, upon opening the lid the smell of pungent odors of gasoline or cleaning solvent or cigarette lighter fluid, very noticeable - even up on top of the ground. This manhole is right off the southeast corner of the Manson Construction Engineering Company building and opposite across East Marginal Way to the east is the Cement Distributors Incorporated warehouse where they have trucks to be serviced and also just southerly of the Liquid Carbide and General Dynamics Corporation, Liquid Carbonic Division. We are also just northerly of the Seattle Boiler Works. While down in the manhole with the gas mask on, cannot see very far, however, can hear a connection coming into the 60-inch line to the south, that from the noise it makes, would guess that it is a substantial flow. Manhole itself is in good condition, however, there is a slick, grease film over all the manhole steps and the sides of the manhole. In this manhole the steps are galvanized, in good shape, however, due to the grease and petroleum film on it, I suggest they should be removed and a portable ladder be used in the future.



Photograph No. 63 - Looking down into manhole.

Manhole No. 34

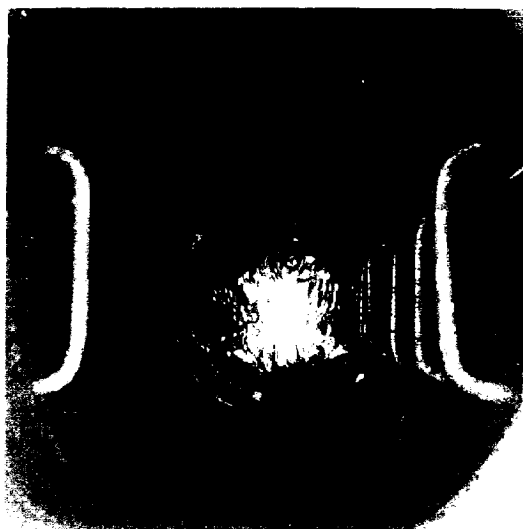
We are opposite the General Electric Company A & C sales at the 5,000 East Marginal Way block and opposite the water tower for the old Corps of Engineers building now being used by Boeing. In manhole No. 34, had the same gas conditions as they had in the previous manhole - scum, greases, petroleum products - on the bottom 2/3 of the way down in the manhole the steps are slick, fairly good galvanized manhole steps, however, the grease makes them very slippery. Also picked up a slight residue or scum sticking to the wall - it appears like the grease scum or cleaning solvent when it has been used in cleaning greasy clothes, etc. This scum is plastered over considerable area and could possibly be the source of some of these pungent smells that we are getting. The manhole in other respects is in good shape, the flow line is clean, no sands and gravels in the bottom, the ring is set firmly on top.



Photograph No. 64 - Looking down into manhole.

Manhole No. 36

Manhole No. 36 lies half way between the two rails of the westerly track - approximately 40 feet south of the north entrance into the old Corps of Engineers building. Same pungent odors, gas, and the same scum on the sides of the manhole. Down in the sewer, there is a large connection or flow coming into the sewer northerly of this manhole, as determined from the noise. With the gas mask and equipment on, was unable to see too far down into the sewer. Manhole structure and the rungs are the same as described in manhole No. 35. In the middle of the concrete drive on the northerly edge of the Corps of Engineers installation, just inside the property line and the security fence, is a manhole marked "sewer" and I would suspect this large flow is coming in from that direction. Later upon opening this manhole, which is a sewer coming from the Corps of Engineers building, we find that this is where the flow is coming from and it has a shear gate to shut off, plus it has a Kennison nozzle to measure the flow with.



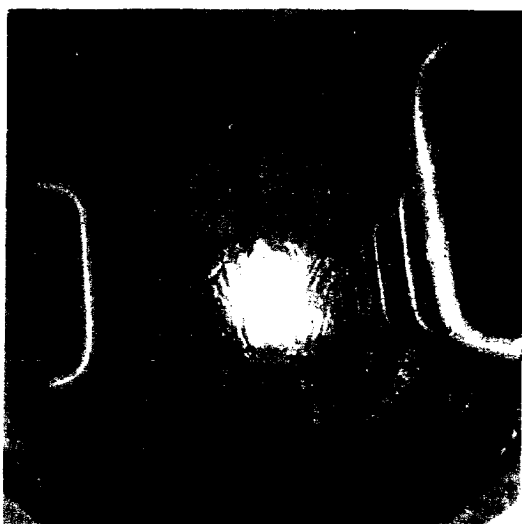
Photograph No. 66 - Looking down into manhole.



Photograph No. 67 - Looking down into manhole on old Corps of Engineers service sewer - Kennison nozzle visible - shear gate on pipe at outlet of manhole visible on right.

Manhole X

Manhole X lies between the railroad rails of the most westerly railroad track. It is the last manhole on the run of 60-inch piping that is parallel to East Marginal Way. Northerly of this manhole there is a curve to the left, thence a straight run of 60-inch pipe to the bypass manhole of the existing Diagonal Way treatment plant, thence straight into a motorized sluice gate and thence into the wet well. Manhole is gaseous, with same scum and petroleum products on steps and barrel.



Photograph No. 68 - Looking down into manhole.

Bypass Manhole Diagonal Way Treatment Plant

The chamber of this manhole is rectangular or square with a flume across diagonally - measured down 9.15 feet to the top edge of the flume from the manhole ring. This top edge forms an overflow weir for entrance into the 30-inch treatment plant bypass line. Measured 12.15 feet down from the rim to the invert of the 30-inch pipe at the southwesterly end of the flume. Thence measured 19.28 feet down to the crown of the 30-inch pipe going out of this manhole (at west wall).

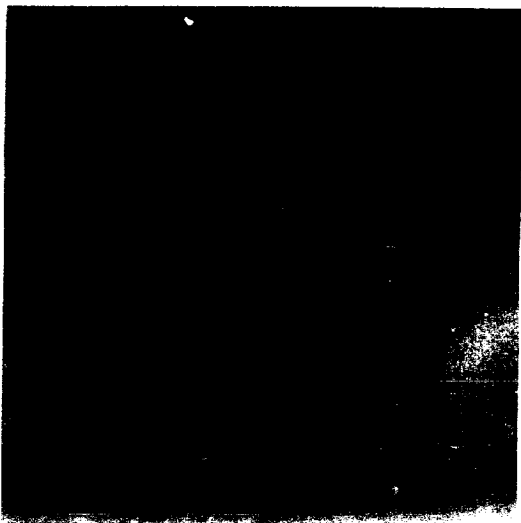


Photograph No. 69 - Looking down into treatment plant bypass manhole - 60-inch trunk enters from upper part of picture below the overflow flume - 30-inch outlet trunk to gate and wet well goes out at lower right. Overflow flume is silted 6 inches deep - 30-inch plant bypass line leaves flume at upper right.

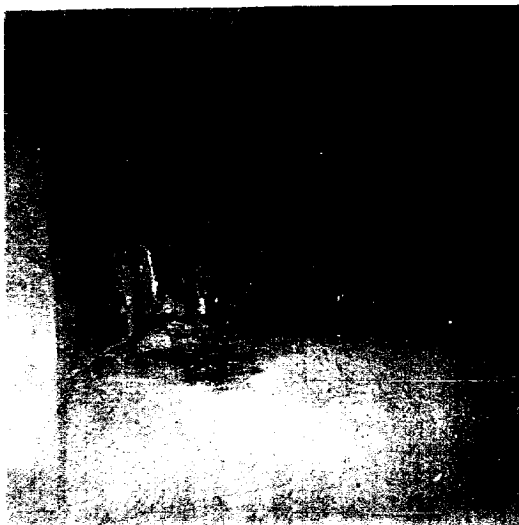
Wet Well of Lift Station at Diagonal Way Treatment Plant

We had the treatment plant operator (Al Pineo) close the motorized sluice gate on the incoming 60-inch trunk thence pump the wet well down till the water level was approximately 0.5 feet over the bottom edge of the bell-mouth intakes.

We measured 8.25 feet down (from the ring on the outside access manhole to the wet well) to the steel plate along the catwalk in the wet well and thence used this as a datum plane for other measurements. We measured 21.38 feet down to the bottom edge of the bell-mouth intakes of the pumps. (All intakes essentially level.) We measured 20.53 feet down to the inner circle of the main pump room floor. We measured 20.20 feet down to the outer circle of the pump room floor at the easterly edge along the wall. We measured the opening of the flared entrance of the incoming chamber to the wet well at 4.4 feet vertical by 8 feet wide with the bottom edge rounded on a 12-inch radius. The flat bottom of this flared entrance was measured at 15.03 feet down from the plate on the catwalk.



Photograph No. 72 - Looking at suction pipes - about 0.5 feet. Submergence on bell-mouthed intakes. Old pressure chamber level indicator at right - vertical pipe between 2nd and 3rd suctions is now used as water level indication.



Photograph No. 70 - Looking into income flow chamber from wet well - sluice gate in background behind plank.



Photograph No. 73 - Looking down on sluice gate with plank in front of it.



Photograph No. 74 - Sluice gate drive machinery. Operator reported that maximum open position safety shut-off switch is broken.